SCIENCE

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## DIAMONDS IN METEORITES.

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THE mineral cabinet of Harvard College received some time ago, through the liberality of Francis Bartlett, Esq., one of the two large masses of meteoric iron first brought by Dr. A. E. Foote from Arizona, and called by him the Cañon Diablo iron. This mass of iron, weighing 154 pounds, is in many ways unique, and chiefly so for the circumstance that it contains diamonds.

This fact was first made known by Professor G. A. Koenig of Philadelphia, who found in cutting one of the fragments that the cutting tool refused to penetrate the wall of a small cavity which it chanced to encounter, and this cavity was found to contain small black diamonds.[1] One white diamond of microscopic dimensions was said to have been found but subsequently lost, and no further account of this interesting occurrence appears to have been published.

In order to determine whether other portions of the Cañon Diablo iron contained diamonds, the author dissolved a mass of about one hundred grams weight in acid, assisted by a battery. The iron was supported on a perforated platinum cone hung in a platinum bowl filled with acid, and the cone was made the positive pole and the dish the negative pole of a Bunsen cell. When the iron had disappeared, there was left on the cone a large amount of a black slime. This was repeatedly washed and the heavier particles collected. This residue examined under a microscope showed black and white particles, the black particles being mainly soft amorphous carbon, while the composition of the white particles appeared less easy to determine, though when rubbed over a watch-glass certain grains readily scratched the surface.

The material was then digested over a steam-bath for many hours with strong hydrofluoric acid, and some of the white particles disappeared, showing them to have been silicious. Most of them, however, resisted the action of the acid. These last were carefully separated by hand, and appeared to the eye like a quantity of fine, white, beach sand, and under the microscope they were transparent and of a brilliant lustre. A single particle was then mounted in a point of metallic lead, and when drawn across a watch-crystal it gave out the familiar singing noise so characteristic of a glass-cutter's tool, and with the same result, namely, of actually cutting the glass completely through. To verify the phenomenon, successive particles were used for the purpose, and with the same result. The experiment was then tried on a topaz, and the same little mineral point was found to scratch topaz almost as readily as it did glass. It was finally applied to a polished sapphire, and readily scratched that also, proving beyond question that this residue of small, white, transparent grains must be diamond, though no well-formed crystals could be recognized.

It has long been known that carbon segregates from meteoric iron in the form of fine-grained graphite; and, when Haidinger found in the Arva iron a cubic form of graphite, it was suggested by Rose that the crystals might be pseudomorphs of graphite after diamond. More recently Fletcher described a cubic form of graphite from the Youngdegin meteorite, under the name of Cliftonite.[2]

Finally, a meteoric stone which was seen to fall at Nowo-Urei, in Russia, in 1886, was discovered two years later to contain one per cent of a carbonaceous material, which not only had the crystalline form of the diamond but also its hardness, so that, instead of being regarded as a pseudomorph after diamond, it was compared with the black diamonds of Brazil, called "carbonado."[3] And, lastly, in the Cañon Diablo iron we have true diamonds, though of minute dimensions. Thus it would appear that, under certain conditions, metallic iron is the matrix of the diamond.

Now, we further know that when cast iron is slowly cooled a considerable portion of the carbon separates in the condition of graphite. Moreover, the high specific gravity of the earth as a whole, as compared with the materials which compose its crust, give us ground for the theory that the interior of our planet may be a mass of molten iron. Therefore it would seem to be not an unreasonable hypothesis, that diamonds may have been separated from this molten metal during the formation of the earth's crust; and a support for this hypothesis may be found in the fact that at the Kimberley mines of South Africa diamonds occur in, what appear to be, volcanic vents, filled with the products of the decomposition of intrusive material thrown up from great depths.

The late Professor H. Carvill Lewis, in examining the materials from the greatest depths of the South African mines, came to the conclusion that the diamonds were formed by the action of the intrusive material on the carbonaceous shale there found, and on this ground predicted the discovery of diamonds in meteorites;[4] but it must be remembered that a similar geological phenomenon appears on a grand scale in Greenland, and no diamonds have as yet been found in the Greenland irons, though they have been so carefully studied by the late Professor J. Lawrence Smith and others.

It is difficult to conceive of any chemical reaction by which diamonds could be formed from the action of melted igneous rock on coal, and all attempts to prepare diamonds artificially by similar means have signally failed.

The writer would urge that the segregation of carbon from molten iron is a well-known phenomenon, and the association of diamonds with amorphous carbon in the meteorite from Arizona indicates that under certain conditions such a segregation may take the form of diamond. The chief of these conditions is doubtless the length of time attending the crystallization, though it may also be affected by pressure; and if the earth, as many believe, is simply a large iron meteorite covered with a crust, it seems perfectly possible that if we could go deep enough below the surface we should find diamonds in great abundance.

[1] American Journal of Science, Vol. XLII., November, 1891.

[2] Min. Mag., 7, 121, 1887.

[3] American Journal of Science, xxvi., p. 74.

[4] British Association, 1886, p. 667.
Ibid, 1887, p. 720.